

Customer No.: 31561
Application No.: 10/711,863
Docket No.: 14098-US-PA

REMARKS

Claim 1 has been amended to include subject matter contained in originally filed claim 10, while claim 10 is currently canceled hereby. Claim 11 has been amended to include subject matter contained in originally filed claim 12. Claim 15 has been amended for better readability. Claims 16-18 are newly added, support for which can be found throughout the specification and the drawings. Specifically, as shown in FIGS. 3E and 3F, the conductive column 342 is a solid column fully of the through hole 302c.

Objection to the Specification

The abstract of the disclosure is objected to because of the use of the phrase "is provided". In response thereto, Applicant has made correction thereby simply deleting that phrase as suggested by the Examiner. As such, Applicant submits that the abstract is now in allowable form.

Claim Rejections – 35 U.S.C. § 102

The Office Action rejected claims 1, 2, 5, 6, and 9-12 under 35 U.S.C. 102(b) as being anticipated by US 3,148,310 (Feldman).

Customer No.: 31561
Application No.: 10/711,863
Docket No.: 14098-US-PA

In response to the rejection thereto, Applicant has amended claim 1 and hereby otherwise traverses this rejection. As such, Applicant submits that claim 1 is now in condition for allowance.

Claim 1, as currently amended, recites:

A method of forming conductive column in a fabrication of a circuit board, the circuit board comprising a dielectric layer formed thereon, the method comprising:

forming a first blind hole in a first surface of the dielectric layer;
forming a second blind hole in a second surface of the dielectric layer opposite to the first surface, a blind end of the first blind hole connecting to a blind end of the second blind hole, the first blind hole and the second blind hole constituting a through hole, wherein an inner diameter of the through hole near the first surface or the second surface is substantially larger than an inner diameter of the through hole near a middle portion of the through hole; and
filling a conductive material in the through hole, wherein the conductive material fills with the through hole from a position where the blind ends of the first and second blind holes connect with each other and extends towards two ends of the through hole to form a conductive column.
... (Emphasis added).

Applicants submit that such a method as set forth in claim 1 is neither taught, disclosed, nor suggested by Feldman, or any of the other cited references, taken alone or in combination.

Customer No.: 31561
Application No.: 10/711,863
Docket No.: 14098-US-PA

Feldman fails to disclose, teach or suggest a step of **"filling a conductive material in the through hole, wherein the conductive material fills with the through hole from a position where the blind ends of the first and second blind holes connect with each other and extends towards two ends of the through hole to form a conductive column ... (Emphasis added)"** as set forth in claim 1 (Emphasis added).

First of all, Applicant submits that Feldman fails to teach a conductive column formed thereby. Feldman teaches that "the thin platinum or rhenium coatings 46 (shown in exaggerated size on the drawing) are plated on the interior surface of certain apertures" (Column 6, lines 56-59; FIG. 4). The thin platinum or rhenium coating 46 is formed by thin film processing such as plating. Such a thin film configured on an interior surface of certain aperture does not read on a conductive column. As defined by Webster online dictionary, the term "column" means *"a supporting pillar; especially : one consisting of a usually round shaft, a capital, and a base"*. Applicant submits that at least in this manner, the thin platinum or rhenium coating 46 is formed on a surface of a through hole even without changing the physical configuration of the through hole, and thus they would not be understood as a conductive column, as required by the present invention as set forth in claim 1.

Secondly, Feldman remains the through hole 42 unfilled for subsequently receiving the spheres 55. In such a way, Feldman teaches only a process of film coating rather than filling the through hole ... to form a conductive column".

Customer No.: 31561
Application No.: 10/711,863
Docket No.: 14098-US-PA

Thirdly, Feldman fails to teach, disclose or suggest that **“the conductive material fills with the through hole from a position where the blind ends of the first and second blind holes connect with each other”**. (Emphasis added)

For at least the foregoing reasons, claim 1 and its dependent claims 2-9 are submitted to be novel and unobvious over Feldman, or any of the other cited references, taken alone or in combination, and thus should be allowed.

Similarly, with respect to claim 11, recites in part:

A circuit board, comprising:

...

at least one conductive column, disposed in the through hole, a shape of the conductive column being substantially consistent to a shape of the through hole ...

Applicant submits that such a circuit board is neither taught, disclosed, nor suggested by Feldman, or any of the other cited references, taken alone or in combination, and thus should be allowed.

As discussed above addressing the allowability of claim 1, Feldman fails to teach a conductive column formed in the through hole. Further, Applicant submits that a thin film formed on an interior surface of a through hole cannot be believed to have any specific 3

Customer No.: 31561
Application No.: 10/711,863
Docket No.: 14098-US-PA

dimensional configuration, e.g., hourglass. Therefore, Feldman is silent about the limitation "a shape of the conductive column being substantially consistent to a shape of the through hole".

Accordingly, Applicant submits that claim 11, and its dependent claim 12 are novel and unobvious over Feldman, or any of the other cited references, taken alone or in combination, and thus should be allowed.

Claims 1-4 and 9-15 are rejected under 35 U.S.C. 102(b) as being anticipated by US 3, 354,543 (Lawrence).

In response thereto, Applicant has amended claim 1 and hereby otherwise traverses this rejection. As such, Applicant submit that claim 1 and its dependent claims 2-4 are novel and patentable over Lawrence, and should be allowed.

Similar to Feldman, Lawrence teaches an electroplating process configuring a conductive copper layer over a surface of the through hole (Column 6, lines 1-15; FIG. 2(e)). Lawrence fails to teach forming a conductive column. Specifically, Lawrence fails to teach the step of **"filling a conductive material in the through hole, wherein the conductive material fills with the through hole from a position where the blind ends of the first and second blind holes connect with each other and extends towards two ends of the through hole to form a conductive column ... (Emphasis added)"** as set forth in claim 1 (Emphasis added).

Customer No.: 31561
Application No.: 10/711,863
Docket No.: 14098-US-PA

Accordingly, the present method as set forth in claim 1 and its dependent claims 2-9, is novel and unobvious over Lawrence, or any of the other cited references, taken alone or in combination, and thus should be allowed.

Likewise, claim 11, recites in part:

A circuit board, comprising:

...

at least one conductive column, disposed in the through hole, a shape of the conductive column being substantially consistent to a shape of the through hole ...

Claim 13, recites in part:

A circuit board, comprising:

...

at least one conductive column, disposed in the through hole, a shape of the conductive column being substantially consistent to a shape of the through hole.

Regarding claims 11 and 13, Lawrence fails to teach "a conductive column formed in the through hole" and "a shape of the conductive column being substantially consistent to a shape of the through hole". Therefore, claims 11 and 13 and their dependent claims 14, and 15 are submitted to be patentable over Lawrence, or any of the other cited references, taken alone or in combination, and thus should be allowed.

Customer No.: 31561
Application No.: 10/711,863
Docket No.: 14098-US-PA

Claims 1, 2, and 7-12 are rejected under 35 U.S.C. 102(b) as being anticipated by US 5,232,548 (Ehrenberg).

In response thereto, Applicant has amended claim 1 to include subject matter of originally filed claim 10, and hereby otherwise traverses this rejection. As such, Applicant submits that claim 1, as currently amended, is neither taught, disclosed, nor suggested by Ehrenberg, or any of the other cited references, taken alone or in combination, and thus should be allowed.

With respect to claim 1, as currently amended, recites:

A method of forming conductive column in a fabrication of a circuit board, the circuit board comprising a dielectric layer formed thereon, the method comprising:

forming a first blind hole in a first surface of the dielectric layer;
forming a second blind hole in a second surface of the dielectric layer
opposite to the first surface, a blind end of the first blind hole connecting to a
blind end of the second blind hole, the first blind hole and the second blind hole
constituting a through hole, wherein an inner diameter of the through hole near
the first surface or the second surface is substantially larger than an inner
diameter of the through hole near a middle portion of the through hole; and
filling a conductive material in the through hole, wherein the conductive
material fills with the through hole from a position where the blind ends of
the first and second blind holes connect with each other and extends
towards two ends of the through hole to form a conductive column.
... (Emphasis added).

Customer No.: 31561
Application No.: 10/711,863
Docket No.: 14098-US-PA

Ehrenberg teaches “[T]he vias 16 and 18 may be created by many standard techniques including, for example, punching, laser drilling, or photo-etching”. Applicant submits that all methods for creating vias 16 and 18 exemplified by Ehrenberg are about to form a via (through hole) in a single process or step. Ehrenberg fails to teach steps of “forming a first blind hole in a first surface of the dielectric layer”, “forming a second blind hole in a second surface of the dielectric layer opposite to the first surface”, as set forth in claim 1, by which the through hole is formed. Ehrenberg also fails to teach “wherein the conductive material fills with the through hole from a position where the blind ends of the first and second blind holes connect with each other and extends towards two ends of the through hole” (Emphasis added).

With respect to claim 11, A circuit board, comprising:

...

at least one conductive column, disposed in the through hole, a shape of the conductive column being substantially consistent to a shape of the through hole, wherein the through hole and the conductive column have an **hourglass shape**.
(Emphasis added)

Ehrenberg fails to teach “the through hole and the conductive column have an **hourglass shape** (Emphasis added)”, as set forth in claim 11, as currently amended. As shown in FIG. 5B, the electrical connections 26 are round columns with the center parts slightly narrowed, however, such a configuration of electrical connections does not qualify an hourglass shape, which should have at least two compartments connected by a sharp neck.

Customer No.: 31561
Application No.: 10/711,863
Docket No.: 14098-US-PA

For failing to teach, suggest or disclose the foregoing limitations as talked above, Ehrenberg fails to teach each and every limitation as set forth in claims 1, and 11, and their dependent claims.

New Claims

Claims 16-18 are newly added, depending on allowable independent claims 1, 11 and 13 respectively, while no new matter has been entered thereby.

Customer No.: 31561
Application No.: 10/711,863
Docket No.: 14098-US-PA

CONCLUSION

For at least the foregoing reasons, it is believed that the pending claims 1-9, 11, and 13-18 are in proper condition for allowance and an action to such effect is earnestly solicited. If the Examiner believes that a telephone conference would expedite the examination of the above-identified patent application, the Examiner is invited to call the undersigned.

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Respectfully submitted,

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